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**OVEN FOR HEATING MOVING THERMOPLASTIC MATERIAL  
CONTAINER BLANKS**

The present invention relates in general to the field  
5 of the manufacture of containers, such as bottles,  
flasks, etc., made of a thermoplastic, such as PET or  
PEN, by blow molding or stretch-blow molding starting  
containers or blanks (preforms or intermediate  
containers) and, more specifically, the invention  
10 relates to the phase during which said blanks are  
heated prior to the blow molding or stretch-blow  
molding step, so as to soften the plastic and make it  
deformable.

15 More precisely, the invention relates to improvements  
made to ovens for heating blanks on the run, especially  
preforms or intermediate containers, made of a  
thermoplastic, this oven including conveying means,  
suitable for supporting and moving the blanks one after  
20 another while rotating each of them about its own axis,  
and heating means placed laterally to the conveying  
means so as to heat the bodies of said moving blanks.

25 So that the stretching process takes place correctly  
and uniformly over the entire body of the blank, it is  
necessary for all of the thermoplastic to be raised to  
a sufficient temperature to be softened without,  
however, this temperature being excessive in order to  
prevent the material from crystallizing. This means  
30 that, despite the poor conductivity of the  
thermoplastic, a sufficient amount of heat (generated  
for example continuously by infrared radiation)  
propagates through the entire thickness of the wall of  
the blank (e.g. heating to the core).

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In the case of certain heating means, such as infrared  
lamps, no purpose is served by forcing the infrared  
transmission power in order to try to achieve this

result more quickly, since the poor thermal conductivity of the thermoplastic entails a certain lapse in time in order to achieve core heating, and a reduction in this time, by increasing the power of the 5 infrared radiation, runs the risk of causing the surface material on the external face of the wall to crystallize. Such a solution must therefore necessarily be discarded.

10 A solution to the problem must therefore be sought in an extension of the time during which the thermoplastic is exposed to the heating means.

One conceivable solution might consist in slowing down 15 the blanks that are moving past the laterally positioned heating means. However, it should also be noted that container manufacturers are constantly seeking to increase production rates, which can be achieved in particular by increasing the machine 20 speeds. Such an aspiration therefore goes counter to lowering the speed of movement of the manufacturing line at any point thereon. This solution must therefore be discarded also.

25 Admittedly, it would be conceivable to reduce the run speed of the blanks through the oven (for example reducing the speed by half), but having two ovens fed in parallel - the total treatment capacity would then be maintained. However, this solution would be very 30 expensive both in terms of equipment and in energy, and must also be discarded.

A useful solution might consist in increasing the length of the oven, which, for a given run speed of the 35 blanks, would lead to an increase in the exposure time. It then becomes conceivable to reduce the transmission power of the heating means, this being permitted by the fact that there is then enough time for the heat to

propagate through the thickness of the wall of the blanks. Admittedly, this solution entails an overcost in terms of equipment, in order to lengthen the oven, but in use it proves to be economic owing to the 5 reduction (which may be up to 35%) in the energy needed for the heat treatment of the blanks.

However, this solution, although generally beneficial for the reasons indicated above, has a drawback due to 10 the great length of the oven thus provided, which proves to be difficult to implement in practice.

It is under these conditions that the invention proposes an improved solution, which meets the 15 requirement expressed by longer exposure of the blanks to the heating means while still avoiding the various disadvantages of the abovementioned solutions.

For this purpose, the invention proposes an oven for 20 heating blanks on the run, especially preforms or intermediate containers, made of a thermoplastic, this oven comprising conveying means, suitable for supporting and moving the blanks one after another while making each of them rotate about its own axis, 25 and heating means placed laterally to the conveying means so as to heat the bodies of said moving blanks, said oven, being designed in accordance with the invention, is characterized in that the conveying means are arranged so as to have at least two conveying 30 branches lying approximately parallel to each other, and near each other, and having opposite conveying directions, the blanks traveling along said two branches one after each other, and the heating means being placed between said two parallel conveying 35 branches and arranged so as to heat, bilaterally and simultaneously, the blanks running in opposite directions along the two conveying branches respectively.

Preferably, the two branches are joined, at one of their ends, by a loop conveying section that is located outside the zone where the heating means act and which 5 consequently constitutes a zone for thermally stabilizing the blanks.

Thanks to this arrangement, each blank passes at least twice through the oven, with an interruption between 10 these two heating phases, which corresponds to the path in which the conveying means turn around and which constitutes a stabilization step during which the heat continues to diffuse into the material. The heating time is thus doubled, and results in a thermoplastic 15 being heat treated under optimum conditions, causing the entire plastic to be heated uniformly and right to the core.

From the structural standpoint, the aforementioned 20 beneficial result is obtained with a single combination of heating means, the effectiveness of which is doubled by the fact that use is made here of their radiation in two directions, and no longer in one direction as in a conventional oven.

25 Admittedly, oven arrangements with two files of moving objects to be treated on either side of heating means are known (see for example documents EP-A-0 868 284 and DE-A-24 27 611). However, in these known arrangements, 30 the two files of objects to be heated move in the same direction. These known ovens make it possible to double the treatment capacity, but each object performs only a single pass through the oven. Consequently, the exposure time of each object is not extended relative 35 to the exposure time of an object passing through a conventional oven (i.e. a single file of objects) of the same length.

In addition, it should be noted that, in an oven with two passes in opposite directions, as recommended in accordance with the invention, the two successive exposures of each object to the heating means, 5 resulting in an increase in the exposure time, may advantageously be accompanied by a reduction in the power of the radiation emitted by said heating means, and therefore by a reduction in the electrical power consumed. This is particularly of interest to the user 10 (trials have demonstrated that the saving obtained, using infrared lamps, amounts to, or even exceeds, 50%).

In one advantageous embodiment, the oven includes two 15 pairs of parallel conveying branches with heating means placed between the two branches of each pair respectively, the four conveying branches being connected together via loop conveying sections located outside the zones where the heating means act. To make 20 a compact oven, it is advantageous for the four conveying branches to be mutually parallel and preferably, for the branches to be approximately rectilinear.

25 Preferably, reflectors may be associated, in a manner known per se, with the heating means, these reflectors being placed alongside each conveying branch on the opposite side from that occupied by the heating means.

30 The invention will be more clearly understood on reading the following detailed description of certain embodiments given as entirely non-limiting examples. In this description, reference will be made to the appended drawings in which:

35 - figure 1 is a simplified diagram illustrating an oven arrangement implementing the provisions of the invention; and

- figure 2 is a simplified diagram illustrating an

advantageous example of oven embodiment exploiting the provisions of figure 1.

Referring firstly to figure 1, an oven 1 is intended  
5 for heating blanks on the run, especially preforms or intermediate containers, made of a thermoplastic such as PET or PEN, it being possible for such an oven to be placed in particular upstream of a blow molding or stretch-blow molding installation for manufacturing  
10 containers.

The oven 1 includes conveying means 2 suitable for supporting and moving blanks (not shown) one after another, while rotating each of them about its own  
15 axis. These conveying means may consist, in a manner known per se, of an articulated sequence or chain of support devices ("spinners") suitable for supporting the blanks by their neck, while at the same time these support devices are rotated (for example by the meshing  
20 of a toothed wheel, which is fastened thereto, with a fixed lateral chain or rack) in such a way that each blank, at the same time as it is being moved, is rotated so that its body is exposed over its entire  
25 periphery to heating means 3 placed laterally to the conveying means.

According to the invention, the conveying means 2 are designed so that at least two conveying branches 4, 5 lie approximately parallel to each other and near each  
30 other, while having opposite directions of movement. The blanks travel, one after another (in series), as shown symbolically by the arrows 6, along the two branches 4, 5.

35 The heating means 3 are placed between the two branches 4, 5 of the conveying means 2 and are designed so as to operate on both sides and to simultaneously heat the blanks moving in opposite directions along the two

branches 4, 5 of the conveying means, respectively.

As an example, figure 1 shows the heating means 3, which here are in the form of three successive sets 7 5 of infrared heating lamps.

The two branches 4, 5 of the conveying means, which in a preferred embodiment are approximately rectilinear inside the oven as illustrated in figure 1, are simply 10 joined to each other, at one end (on the right in figure 1) of the oven 1, by a loop-shaped section 8 of the conveying means.

The loop section 8 of the conveying means, apart from 15 its function of joining together the branches 4, 5 that pass through the oven, also acts as a stabilization zone, allowing the heat to continue to propagate into the thermoplastic and preventing excessive heating of the external face of the body of the blanks.

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The oven 1 is equipped in a manner known per se with reflectors 9 placed facing the heating means 3, on the other side of the branches 4, 5 of the conveying means.

25 In an oven designed according to the invention, each blank passes twice in succession opposite the heating means with an intermediate thermal stabilization period. For an oven of given length, the same heating time is obtained for each preform, with a substantial 30 reduction in the power of the heating means and therefore in the electrical power consumed, without an increase in the number of heating lamps and without increasing the working length of the oven, compared with a conventional oven having a single conveying 35 file, although the preforms are heated more uniformly and to the core.

Figure 2 illustrates schematically a specific example

of an oven implementing the above provisions. In practice, the arrangement illustrated in figure 1 consists in duplicating (with parts A and B) the arrangement shown in figure 1, the blanks then making  
5 four successive passes through the oven, and therefore there are four successive heatings, interspersed with thermal stabilization periods.

The blanks arriving at E are delivered by means 10 (such as a feed wheel) for charging the conveying means 2, consisting of a closed-loop chain 2 of support devices. The chain 2 then enters the part A of the oven 1 via its branch 4A, where the blanks undergo a first heating operation, and then, after passing along the  
15 loop section 8A, a second heating operation on the branch 5A.

The blanks then pass along a joining section 11, which also defines a thermal stabilization zone, bringing  
20 them to the second part B of the oven, in which they follow a similar path: branch 4B with heating, loop section 8B with thermal stabilization, branch 5B with heating.

25 On leaving the branch 5B, a section 12 brings the blanks to the unloading means 13 (such as a "discharging" wheel) where they are detached from the support devices of the chain 2 (which chain returns to the charging means 10) and are discharged at S toward,  
30 for example, a blow molding or stretch-blow molding unit. Since the discharging means 13 are not immediately adjacent to the exit of the oven, the section 12 itself constitutes a thermal stabilization zone that completes the diffusion of heat into the  
35 thermoplastic.

The four branches 4A, 5A, 4B, 5B may be mutually parallel so that it is possible to construct an oven of

simple and compact design, with little heat loss. Furthermore, it is possible to place, in the central part, between the abovementioned parts A and B of the oven, members that are common to the operation of these 5 two parts A and B, and especially a fan delivering the gas that cools the surface of the blanks.